# Description

# [Digital laser dot map thermal image decoy for Infrared countermeasure against FPA based missile and IRST w HSS]

## CROSS REFERENCE TO RELATED APPLICATIONS

[0001] US patent number :

6662700;6587486;6420721;6674520;6410897.

## BACKGROUND OF INVENTION

[0002] This invention relates to an approach to protect aircraft and other vehicle against threats that use high resolution (Hi Res) FPA (focus plane array)detector based IR missile and IRST(Infrared Search and Track)/HSS (helmet sight system). Threats against military aircraft and vehicle , such as air-launched or ground-launched heat seeking missiles are typically guided by an infrared sensor, Infrared sensors, on the other hand, are passive devices that do not reveal their presence or operation. The great majority of aircraft losses to hostile attacks over the past decades have been to infrared-guided missiles.

Especially since the high resolution IR FPA detector and computer based thermal image identify technology has been widely used in both IR missiles and IRST w HSS, it made traditional countermeasure of infrared guided missiles become much more difficult than ever before or even impossible. There are a number of countermeasures to defeat infrared-guided missiles. Historically, the most common countermeasure has been the use of torches that produce an IR signature as a decoy to confuse the infrared seeking missiles. The new generation of High Resolution FPA (Focus Plane Array) based infrared-guided missiles utilize counter-jamming programmed to ignore torches, based upon distinguishing the thermal image of the torches to than the previously acquired target and/or their different heat-emitting properties in the thermal image as compared with the previously acquired target and their different motion than the previously acquired target. IR Lamps and directional lasers may be used to blind or confuse the infrared sensor, but these approaches will be defeated by much intelligent hardware and software of Hi Res FPA detector based counter-countermeasure system, such as laser protection optic filter, algorithm of thermal image identification in IRST and missiles, and further more the pilot behind HSS. Also to blind

or burn the IR detector of missile or IRST need large power consumption and accurate aiming system but both airplane laser power and space is so limited, and plus FPA has 320x240 or 640x480 detecting pixels, even some of them burned out, the left pixels still can sense IR and send back the thermal image of target.

## SUMMARY OF INVENTION

[0003] A threat detector must be employed to tell the location of incoming missile or airplane. The digital vector thermal image of the airplane or vehicle of all direction of view is captured and stored in computer, also thermal image from missile eye of view is stored in data base. A 3-5 and 8-12 micron meter multi-wavelength laser generator with modulating input and driver with controllable energy level , dot size function, Send those images to laser scanner with optic project system, by mapping and projecting the laser dot which dot has been controlled in size, shape, density and energy level according to grayscale of the digital thermal image output from computer, forming frames of scalable , skew- able laser dot map photographic thermal image to FCA of incoming missile and airplane IRST w HSS. FPA of missile and IRST w HSS will pick up the Laser

Dot Map thermal image decoy, the false signal, and converted to digital high resolution image in their image processing system. By skewing, scaling and rotating the digital vector image in vehicle countermeasure device computer, manipulating the Laser Dot Map thermal image to the position away from airplane or vehicle, the missile will be diverted to the position that away from airplane or vehicle, system will keep sending countermeasure signal until the threat disappear from detector.

## BRIEF DESCRIPTION OF DRAWINGS

[0004] Fig 1.block diagram of the system.

[0005] Fig 2. Basic drawing shows the relation between missile and

[0006] countermeasure.

[0007] Fig 3. Showing Digital thermal image, Scanning, projecting, and servo

[0008] system.

## DETAILED DESCRIPTION

[0009] The best countermeasure to against missile or IRST w HSS is to deceive them and remove them from target position. The high

resolution and high frame rate FPA infrared detector used in missiles and IRST/HSS technology can capture sharp high resolution (high gray scale level) photographical thermal image of the target, such as aircraft or vehicle, that feedback image allow digital image identification system to filter out the false signal easily, and also the High Resolution thermal image of the target allow the pilot behind Helmet Sight system can guide missile back to the right track. On the other hand, reverse thinking, FPA will also leave a door for digital high fidelity image decoy, FPA with high density pixel array plane is good place make laser dot map digital thermal image, by mapping each laser dot with different energy level to FPA matrix pixel, turning each pixel of FPA, It will form a gray-scaled thermal image in missile or IRST image processing unit and if the thermal image is to real to tell, the system will be deceived. In order to countermeasure the FPA based IRST w HSS and missile, the digital laser image system must project the high resolution and high fidelity thermal photographic image as decoy of the airplane or vehicle to the missile and IRST w HSS and mask airplane or vehicle behind this projected thermal image. To achieve this result, this invention comprise computer digital thermal image, controllable laser drive, high speed

scanner and optic focus system, project the digital laser dot map forming thermal image in spatial. At first this projected motion digital thermal image of the target will deception the IRST w HSS and missile because this dynamic projected digital thermal image is identical to the target's nature thermal image, and then by skewing, scaling, rotating and shifting the vector thermal image, furthermore the manipulated laser dot map thermal image, the missile will be trapped to a position that away from the real target, such as airplane. This invention relates to digital image modulating laser dot, scanning laser dot and mapping them in spatial , and forming a infrared photographic image on FPA of missile or IRST and more particularly and generically to vector image which laser dot mapped high resolution infrared image is projected to the spatial by the 3 dimensions X, Y, Z axis laser high frame rate galvanometer based optical scanning system and gimbaled directional servo system that controlled by a missile threat detector and locator. Those mapped laser dot will form a digital thermal image on FPA detector of the incoming missiles or IRST/HSS. This laser dot map thermal Image is processed by the electronic display system and the demodulate the laser dot map image to a photographic thermal image in the viewer of the pilot or missile guiding unit. Fig 1.

Fig.2, Fig 3. The modulation and mapping of laser dot in parameter of firing time, shape, density, energy level and size, due to it has been a mature technology for long time in laser industry, has been accomplished easily by digital photographic software and laser control drive and scanner. To map the laser dot image to the FPA detector of incoming missile or IRST w HSS of airplane, countermeasure system employ a computer database which stores the vector thermal image of airplanes or vehicles in view of 360 degree, such as front view, left view, right view, rear view, head up view and bird view, those pictures should be taken by different infrared camera that use 3-5 micron and 8-12 micron wavelength IR detector. Computer output stored digital thermal image to laser drive to modulate the laser dots that from multi- wavelength of 3-5 and 8-12 micron laser by control the laser energy level, fire time and size based on gray scale of the digital image , and the high RPM X-Y- Z axis 3 dimension coordinate scanning system to map the laser dot in a frame and form laser dot map image toward the incoming missile and airplane. The FBA of the missile convert the Laser Dot Map image into pixel thermal image and send signal to the missile guiding system. In order to project Laser Dot Map photo image frame by frame and right on the path of

missile or airplane, the X, Y, Z-axis 3 dimension coordinate scanning system and gimbaled servo must be used to compensation airplane motion. The vector image in computer can be scaled, skew, rotated, so the projected laser dot map thermal image can deceive the IR guided missile and IRST w HSS, and let missiles move away from the real target. In general, it is the purpose of the laser dot map thermal photographic image infrared countermeasure device to produce a laser photographic thermal image that of sufficiently high intensity to mask the real infrared thermal image and infrared signature output from the above mentioned airplane or vehicle. Missile threading detector sensing the incoming missile and send the position signal to computer . Computer send the thermal image which mach the view of the missile coming direction, gimbaled platform turn the scanner projecting lens toward the missile , The moving Laser Dot Map infrared image become the prey of the heat seeking missiles or IRST w HSS. By Skewing , scaling and swing the laser dot IR image, the IR seeking missile will lost the real target and chase the mirror image. It is therefore important to provide an IR photographic image countermeasure system which can simultaneously countermeasure both IRST w HSS and missiles with fidelity

digital thermal image. the mirror thermal image is a exactly same as the computer stored digital thermal image of the airplane or vehicle, the laser dot map image can be in mapped 300dpi , 600 dpi or 1200 dpi resolution with controllable high intensity laser . Hi resolution FPA based missile and IRST helmet sight system will process the Laser Dot Map thermal stunt image as the target. Fig. 3.